Provincial health inequalities in Spain since 1860

Gregori Galofré-Vilà
Universidad Pública de Navarra & INARBE

María Gómez-León
Universidad Pública de Navarra & INARBE

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Abstract: Using annual mortality rates at the provincial level for men and women, we construct a Gini index to estimate changes in regional health inequalities since 1860 in Spain. We find a long steady decline in health inequality across provinces from 1860 until today, interrupted only by World War I and the Spanish Civil War. Franco's 40-year legacy in terms of health is one of health inequality. Today, regional differences across provinces are at their lowest historical levels.

Authors: Gregori Galofré Vilà and María Gómez León, Universidad Pública de Navarra & INARBE.

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JEL codes: J11, N23, N24, N93, N94.

1. Introduction

Before the COVID-19 pandemic, Spain ranked among the healthiest places to live. As Table 1 shows, around 1880, the average life expectancy of a newborn boy in Spain was 30 years, compared to 33 years in Italy, 39 in the United States and 43 in France. Yet, by 1980, Spain had caught up with Italy, France and the United States and in 2019 it only trails Japan globally.

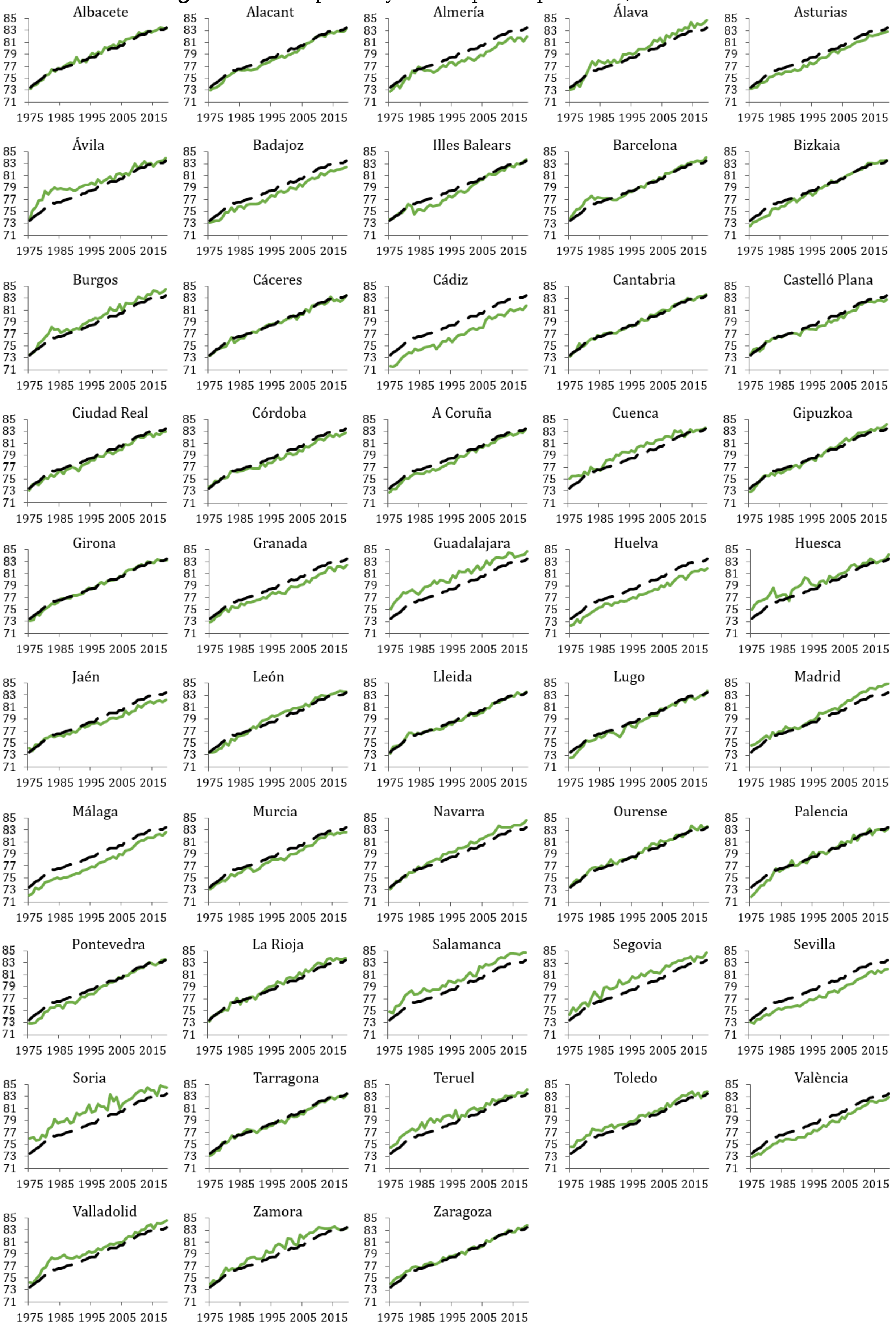
Table 1. Life expectancy in Spain and selected Western countries, 1860-2019

Year	France	Italy	Japan	South Korea	Spain	USA
1880	42.7	32.8	37.0	-	29.5	39.4
1900	45.0	41.7	38.6	-	34.8	49.3
1920	51.5	45.5	42.0	29.5	39.2	55.4
1940	49.6	57.0	-	44.9	48.4	63.2
1960	70.2	69.1	67.9	55.2	69.0	69.9
1980	74.2	74.2	76.3	66.1	75.3	73.9
2000	79.0	79.6	81.2	76.1	79.3	76.8
2019	82.7	83.5	84.6	83.0	83.6	78.9

Notes: Life expectancy at birth is defined as the average number of years that a newborn could expect to live if he or she were to pass through life subject to the age-specific mortality rates of a given period. *Sources*: Data are from Riley (2005).

However, a close look at Spanish life expectancy in recent decades also shows heterogeneity across provinces with some places falling behind (Figure 1). For instance, in 2019 the average life expectancy at birth in Alava, Guadalajara, Navarra, Salamanca, Segovia, Soria, and Valladolid was above 84.5 years, and exceeding 85 years in the case of Madrid. By contrast, a newborn in Almería, Cádiz, Huelva, and Sevilla could expect to live less than 82 years, reaching only 81 in the case of Ceuta and Melilla. These patterns draw a north/south divide (Figure A1), with higher values in the center and northern areas, and lower in the south and southwestern regions.

Figure 1. Life expectancy in the Spanish provinces, 1975–2019



Notes: Solid green lines show provincial annual average life expectancy at birth and dashed black lines show annual average life expectancy at birth in Spain. Life expectancy at birth is defined as the average number of years that a newborn could expect to live if he or she were to pass through life subject to the age-specific mortality rates of a given period. As explained in Section 2, we are not showing data from Ceuta, Melilla, Santa Cruz de Tenerife, and Las Palmas. *Sources*: *Instituto Nacional de Estadística*.

Given these gaps in recent decades, in this paper we document, for the first time, how health has varied across Spanish provinces in the last 150 years. Using official sources of death registers, we created a new data set with the number of yearly deaths per 1,000 population at the provincial level by sex. We focus on crude death rates, as historical age-adjusted population data to estimate life expectancies at birth are only available at census years (about every 10 years). While, in essence, our work is descriptive in nature, we compute a Gini index and additional inequality indicators such as the Theil index and sigma- or beta-convergence to record distances in mortality rates across Spanish provinces.

By exploring these indices, we find that since 1860, there has been a process of health inequality reduction (i.e., a process of convergence) between Spanish provinces, which was interrupted in time during the Spanish Civil War and Franco's dictatorship (1936–1975), and resumed from 1980 onwards. Using cause-specific mortality, we find that this last period of convergence is likely to be driven by advances in preventive mortality (i.e., deaths from cancer) and communicable and infectious diseases such as influenza and pneumonia. We also find divergence in recent decades in deaths from coronary and cardiovascular diseases. Finally, throughout, we also highlight some historical junctures and policies that can be behind periods of convergence or divergence.

While there is a wealth of research on health inequalities driven by socioeconomic and educational groups (Case and Deaton 2015 and Currie and Schwandt 2016), our paper is among the few exploring adult health inequalities historically. One notable exception is the recent work of Bonnet and D′Albis (2020), which explored convergence and divergence in life expectancy across French departments since the beginning of the 19th century. Between 1800 and 1880 they find zigzagged periods of convergence and divergence, followed by a century-long period of convergence. For the most recent decades, they discuss short-lived periods of divergence, where rising life expectancy tends to happen only in areas where longevity was already high. Another related paper is the work from Feigenbaum et al. (2019), showing that not only were deaths from infectious diseases higher in the U.S. South in the first half of the 20th century, but they also started to decline later than elsewhere in the country.

For the Spanish case, Pérez Moreda et al. (2015) also explored changes in mortality spatially, but their work is limited to urban regional differences during the first third of the 20th century. The work from Cussó and Nicolau (2000), Gómez Redondo (1992) and Sanz Gimeno and Ramiro Fariñas (1999) is also very relevant here, but these studies aimed to explore infant and child mortality only at some benchmark years. Finally, our work directly connects with González and

Rodríguez-González (2021), but while they begin to document regional health differences in 1990, we can go back to 1860.

There is also a broad and rich body of economic history literature looking at regional income inequality in Spain using GDP data (Diez Minguela et al. 2018; Rosés et al. 2010; Rosés and Wolf 2018; Martínez-Galarraga et al. 2018), real wages (Rosés and Sánchez-Alonso 2004) with some papers examining regional inequality and education (Beltrán Tapia et al. 2021; Beltrán Tapia and Martínez-Galarraga 2018) and economic growth (Beltrán Tapia and Martinez-Galarraga 2020, Martínez-Galarraga et al. 2015). Ultimately, our work directly contributes to this strand of scholarship, looking at the regional differences in health in the long run. The paper continues as follows. We next present our data (Section 2.1) and methodology (Section 2.2) to compute the mortality Gini index. Section 3 describes the patterns of inequality in mortality over time and put them into an historical narrative. Section 4 concludes.

2. Data and Methods

2.1. Data

Using a previously untapped data source to explore regional health inequalities, the *Movimiento Nacional de la Población*, edited by the *Instituto Geográfico y Estadístico* we have manually transcribed the annual number of deaths for each of the 48 Spanish provinces since 1860 for men and women. For geographical reasons, we did not transcribe data from the provinces of Ceuta and Melilla (located in Africa) and Santa Cruz de Tenerife and Las Palmas, lying far away from the Spanish peninsula.

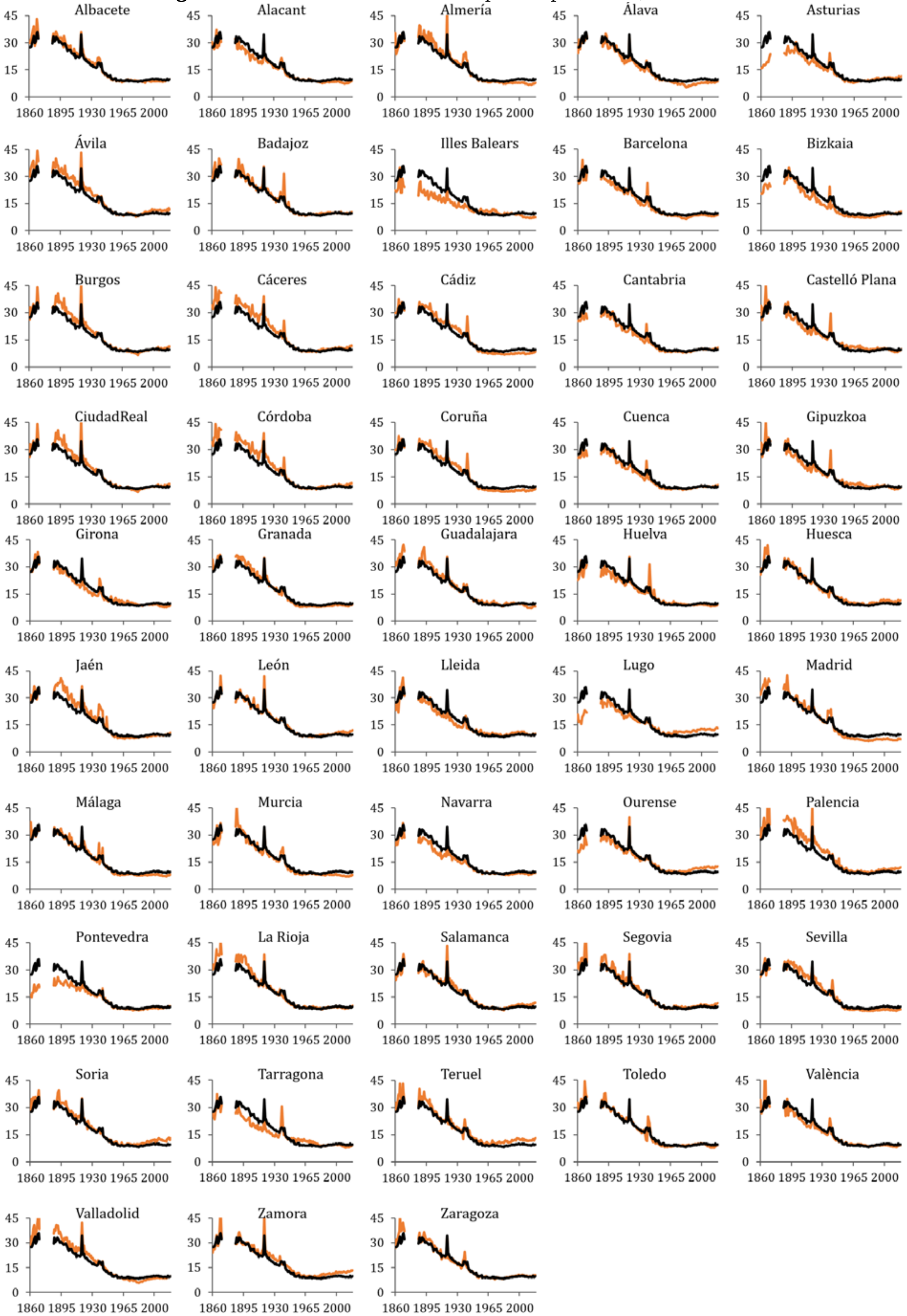
Because annual population figures at the provincial level are only available in census years (a census was made each decade), our outcome measure is simply the crude death rate (i.e., the number of deaths within a population). We computed it by dividing the annual deaths in the province i and year t by the population in the same province i and year t, where the annual population is interpolated between census years and per thousand. To control for the process of ageing, after 1975 we use the official age-adjusted mortality statistics from the *Instituto Nacional de Estadística*. Unfortunately, we have a gap in the data, as the *Movimiento Nacional de la Población* was not printed between 1871 and 1885, and mortality data by sex were also unreported between 1886 and 1899 (registering only total mortality). Note that when we compute crude death rates for men and women, in the denominator we use the male or female population in the province i and year t.

Figure 2 displays the evolution of the crude death rates in each of the Spanish provinces from 1860 onwards and compares it with the Spanish mean. Mortality reached its peak in the 1870s and then started a long fall, reaching a plateau already in the 1960s until today. The demographic transition accounted for this decline (Omran 1971). Starting from a regime of high birth and death rates and slow population growth, from 1880 onwards the death rate began to fall, accelerating the population increase. Then mortality and population were stabilized in the first half of the 20th century, when birth rates also fell, and the demographic transition was completed by 1960.

Looking at the chronology of mortality over time, it is possible to see a short-lived peak of mortality in 1918, due to the 1918 influenza pandemic, and another increase of mortality during the second half of the 1930s, due to the Spanish Civil War.[1] Spatially, by 1860, the north/south divide was already visible, with the provinces that registered higher mortality rates located in the South and Levante, including Almeria, Caceres, Granada, Málaga and Valencia, and places with lower mortality rates clustered in the North, including Asturias, Bizkaia, Gipuzkoa, La Coruña, Lugo, and Pontevedra.[2]

[1] What is not shown in figure 2 (due to lack of data), is the cholera epidemic of 1885 (believed to have killed 120,000 people) and representing another major peak in the Spanish trend.
[2] The case of Madrid is of special importance, as while historically it was above the Spanish mean, after the Civil War and, for political reasons, given its interest as the capital of Spain, it turned to be one of the healthiest places.

Figure 2. Crude death rates in the Spanish provinces, 1860–2017

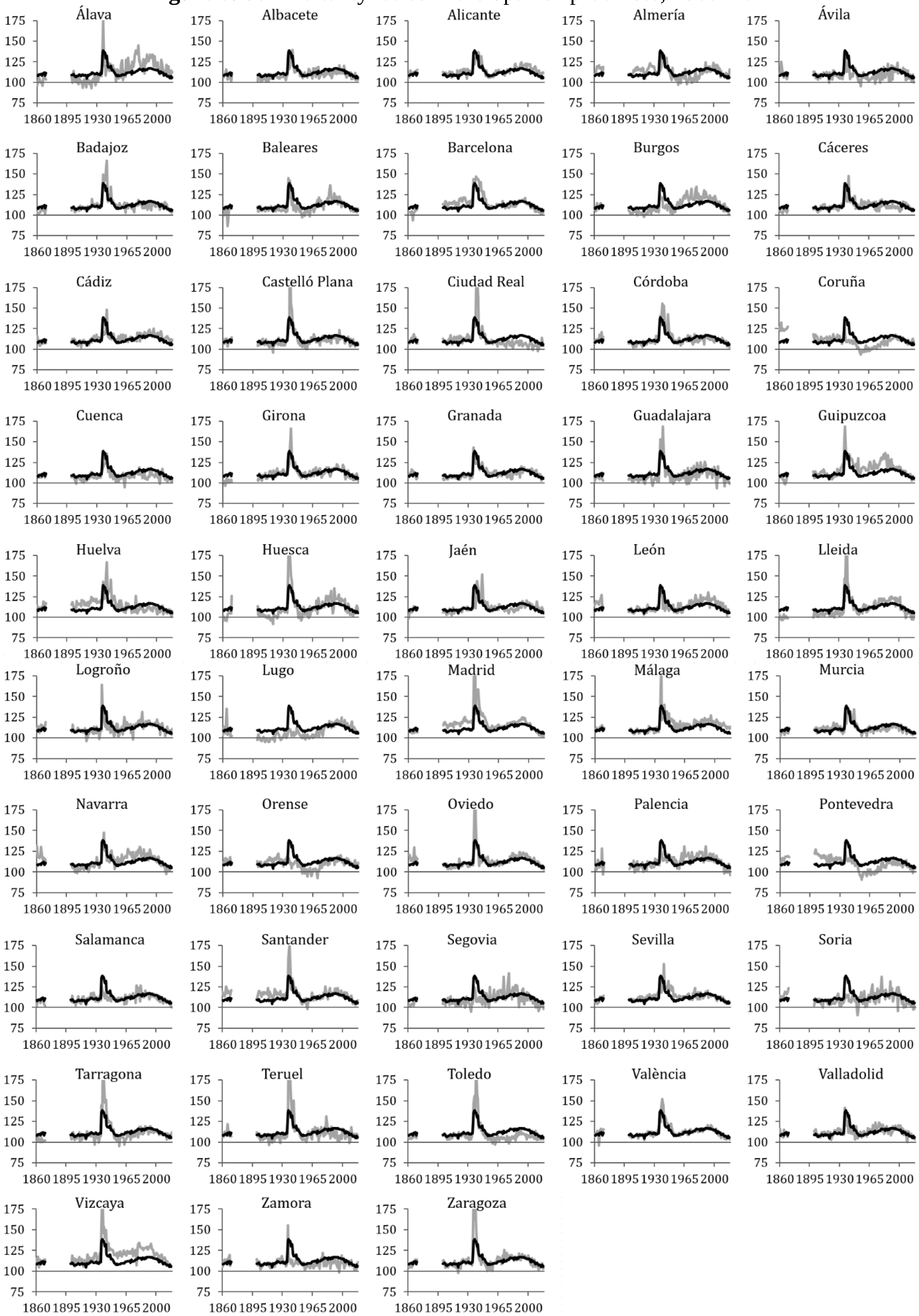


Notes: Light orange lines show annual average crude death rates in particular provinces. Dark black lines show annual average crude death rates in Spain overall. As explained in Section 2, we are not showing data from Ceuta, Melilla, Santa Cruz de Tenerife, and Las

Palmas. *Sources*: Mortality data are from *Movimiento Nacional de la Población* and population data from census years, for more details see Section 2.1.

Beyond differences in total mortality, we also computed sex mortality ratios (the ratio of male to female death rates per hundred) across time in the different provinces (Figure 3). Broadly speaking, women, due to biological factors, lifestyles, and risk behaviors, had nearly always achieved lower mortality rates than men (Goldin and Lleras-Muney 2019). Nevertheless, in the last 50 years, there has been wide heterogeneity in the male to female mortality ratio across the different provinces, with some provinces registering low sex mortality ratios (such as Caceres, Ciudad Real, and Jaen) when compared to others (Álava, Baleares, Burgos and Gipuzkoa). Differences here are mainly due to cause-specific mortalities (Pérez Moreda et al. 2015). The sex mortality ratios also show how during the Civil War, men who were sent to the front died prematurely. However, there is less evidence of gender discrimination in mortality during the 1918 influenza pandemic.

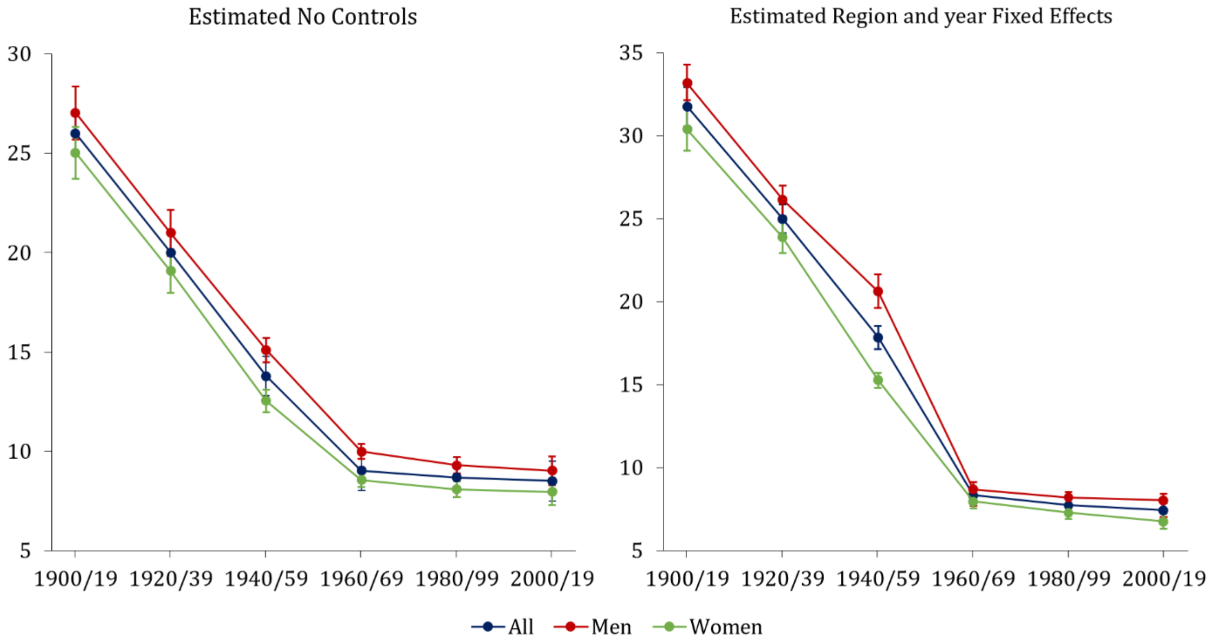
Figure 3. Sex mortality ratios in the Spanish provinces, 1860–2017



Notes: Light gray lines show annual sex mortality ratios and dark black lines show annual average sex mortality ratios in Spain. As explained in Section 2, we are not showing data from Ceuta, Melilla, Santa Cruz de Tenerife, and Las Palmas. *Sources*: Mortality data are from *Movimiento Nacional de la Población* and population data from census years, for more details see Section 2.1.

To control for unobservables in the crude death rates, such as the age distribution and the environmental and social characteristics of the provinces, we next examine the timing of the decline in mortality with a simple OLS regression model, with the crude death rates as outcome and regressing the mortality on region[3] and year dummies, and clustering the standard errors at the provincial level (Figure 4). We combined the provincial crude death rates into groups of 20 years (1900–1919, 1920–1939, etc.) where point estimates represent the slope coefficients, measuring the pace of the mortality decline. Bars plot 95% confidence intervals, and for comparison, we also present the slopes without region or time fixed effects (left figure). Looking down the figure, the means declined gradually, showing that mortality declined over time. This pattern appears to hold for men and women, but means are nearly always higher for men, and in the period 1940–1959, differences in sex mortality get bigger, despite being statistically significant only when adding the regional and year fixed effects.

Figure 4. Estimated region fixed-effect and year-effect coefficients.



Notes: The outcome variable is the crude death rate in the province *i* and year *t*. In the right figure we employ region fixed-effect and year-effect coefficients. We fit separate regressions for each period, allowing the year effect to differ across regions. We plot 95% confidence intervals from the regressions around each coefficient, clustering standard errors at the provincial level. *Sources*: Mortality data are from *Movimiento Nacional de la Población* and population data from census years, for more details see Section 2.1.

2.2. Methods

Using the annual provincial crude death rates, we next compute the Gini index to measure health inequality. The Gini index is a measure of inequality, which measures the extent to which a variable "y" (usually income or wealth) is equally or unequally distributed among individuals. The Gini

[3] For region we deploy the *Comunidad Autonoma* distinction, one of the highest levels of aggregation.

(expressed in percentages) ranges from 0 to 100, where 0 would denote a perfect egalitarian distribution of "y" among individuals and 100 would indicate that "y" is fully concentrated by one individual. While the Gini index is generally used to study income and wealth concentration, it has also proved to be useful to assess inequalities in other dimensions, such as life expectancy and mortality (Peltzman 2009). For its computation we use the following equation:

$$G = \frac{1}{CDR} \sum_{i<j}^{n} p_i p_j (y_j - y_i) \tag{1}$$

where n is the number of provinces, CDR is the overall mean crude death rate, p_i is the proportion of people belonging to the i-th province, and y_i is the mean crude death rate of people belonging to the i-th province, with provinces ranked in ascending order ($y_j > y_i$). As Peltzman (2009) notes, the interpretation of the Gini index for mortality is also analogous to that for income. The Gini coefficients will grow with the degree to which Spain's mortality is concentrated in a few provinces. In a perfect egalitarian situation (a Gini coefficient equal to 0), each province would have the same crude death rate. Oppositely, in a situation of maximum inequality (with a Gini coefficient of 100), one province will concentrate all the national mortality.

Beyond these two situations at the extremes, in practice, it is important to consider that, as we showed in Figure 2, the crude death rate of each province will be bounded by the nature of death, where the Gini coefficients will be affected by the absolute variability of the crude death rates over space and time. Thus, our mortality Gini based on provincial data would range from 4 to 13. When we look at cause-specific mortality (in Section 3.4), since there is more variation across provinces, for some causes of death such as influenza, the mortality Gini ranges from 15 to 35. Unfortunately, for comparison, we are only aware of the Gini index using regional French data in life expectancy, which, similarly to our levels, have a maximum value in the Gini of around 15 (Bonnet and D′Albis 2020, Fig. 2). For robustness, we computed a Gini using the provincial Spanish GDP per capita data (Diez Minguela et al. 2018), and they range from 11 to 21. Finally, income Gini indices typically range from 20 to 70 (Ferreira and Ravallion 2009). But this is based on national income data (not exploiting regional variation) and the income of a given population can range from 0 to extremely high values (i.e., very rich people).

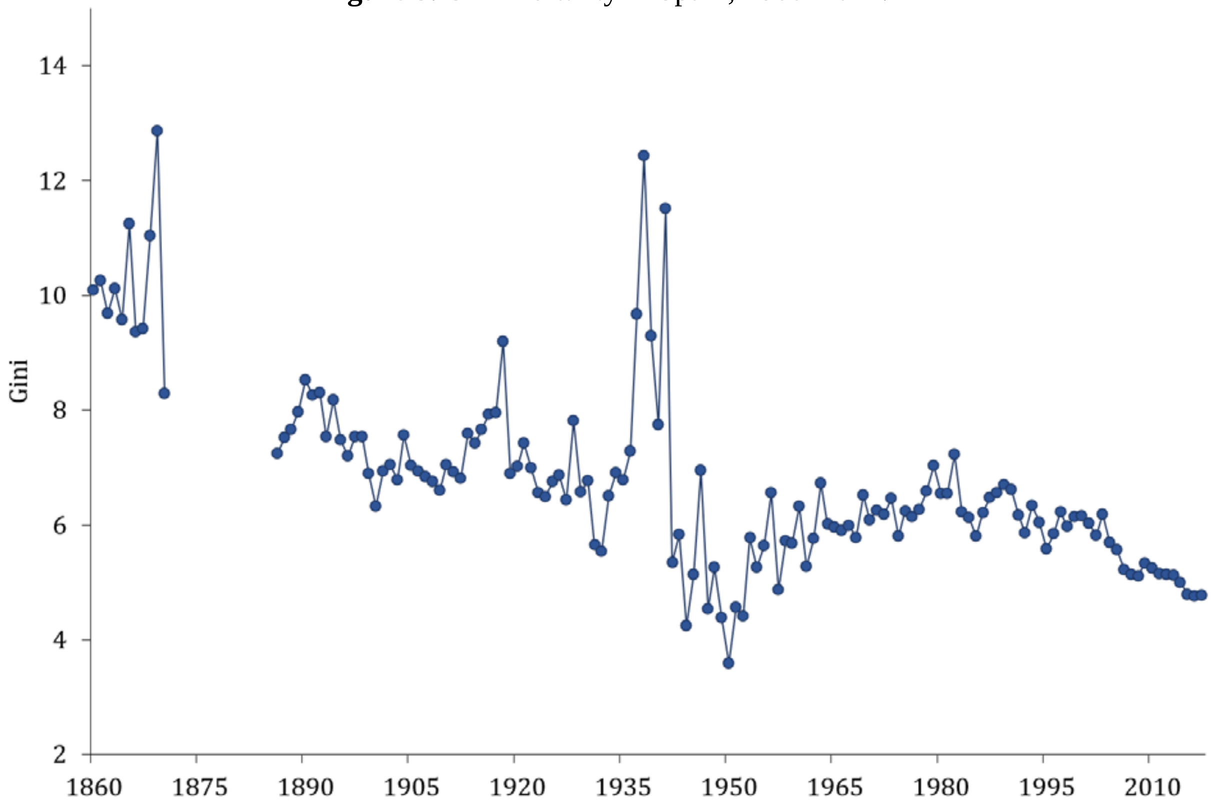
3. Regional health inequalities

3.1. Main results and robustness

Figure 5 displays the evolution of the total mortality Gini between 1860 and 2017. While we discuss the details of the mortality Gini for the different historical periods in the next sections, briefly, during the second half of the 19th century, there was a stable decline in regional health inequalities, with Gini moving from 10 (in 1860) to 6.3 (in 1900). This decline was somewhat disrupted during the early 20th century and in particular during World War I and the 1918 influenza pandemic, with regional inequalities reaching a Gini value of 9.2 in 1918. From the end of World War I to the arrival of the Second Republic (1931), Spain registered a new drop in health inequalities across provinces (with Gini coefficients falling to 5.5 in 1931). Regional health inequalities skyrocketed during the Spanish Civil War (1936–1939), reaching a peak in 1938 (with a Gini coefficient of 12.4), to rapidly fall again during the postwar years, with the Gini coefficient reaching its minimum (3.6) in 1950. A reversal occurred coinciding with Franco's seizure to power, and regional health inequalities increased by 3 Gini points between 1950 and 1978.[4] However, during the 1980s, under democracy, regional health inequalities resumed the downward trajectory initiated in the mid-19th century. Therefore, it is possible to identify two periods of health convergence between provinces (1860s–1950s, 1980s–2017) interrupted by three periods of increasing health inequalities (1910s–1920s, 1936–1939 and 1950–1980s). In Figure A2 we summarize the Gini coefficients within these major historical periods and in Figure A3 we compare the movement in the level of mortality to movements in inequality for each decade. There is a positive connection, and declines in mortality are associated with declines in the Gini mortality.

[4] While Franco died in 1975, the first free elections following the dictatorship were celebrated in 1977 and a constitution was approved by referendum in 1978.

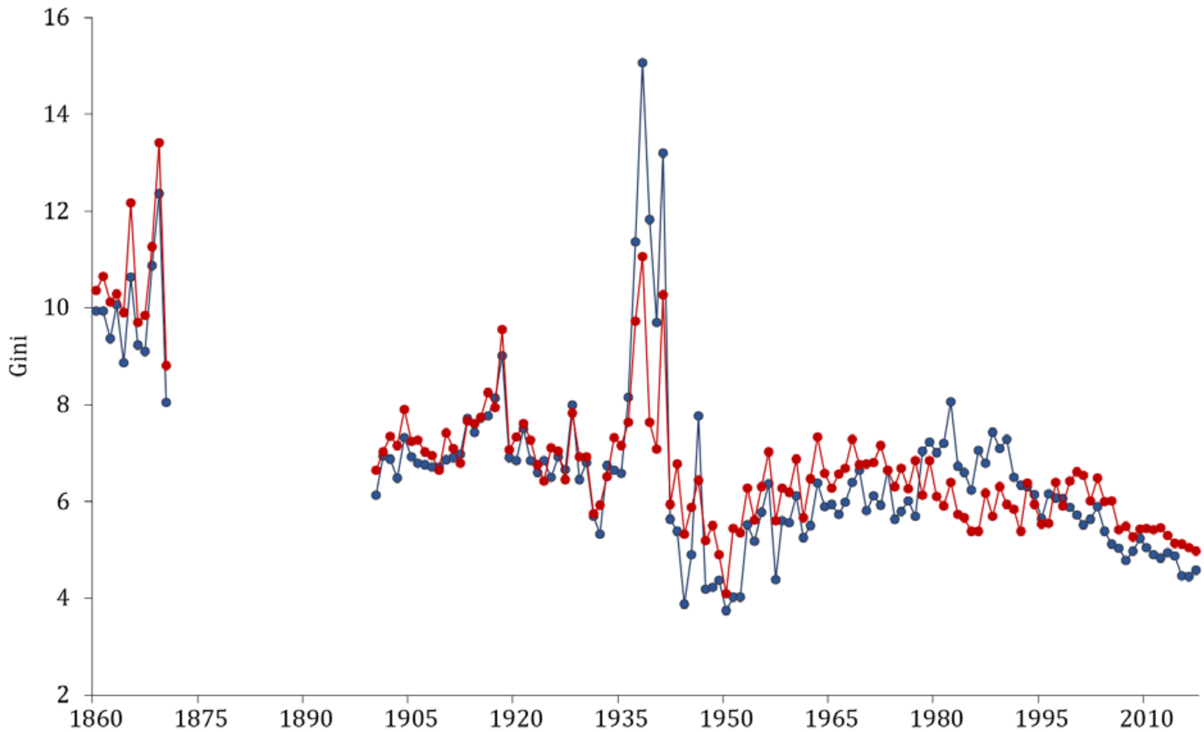
Figure 5. Gini mortality in Spain, 1860–2017.



Notes: Gini coefficients are expressed as percentages and range from 0 to 100. *Sources*: Mortality data are from *Movimiento Nacional de la Población* and population data from census years, for more details see Section 2.1.

Given the sex mortality ratios shown in Figure 3 and how they evolved over time, we computed the mortality Gini separately for men and women. Results by gender (Figure 6) show that the mortality Gini moved roughly in tandem for men and women. Yet there are some periods of divergence, first during the Civil War and then during the first years of the transition to democracy, where mortality inequality levels were higher among men than among women. Meanwhile, levels of inequality in mortality among women were higher than those registered between males under the dictatorship, and during the two most recent decades.

Figure 6. Mortality Gini by sex, 1860–2017



Notes: Gini coefficients are expressed as percentages and range from 0 to 100. For details on methods see text at Figure 5. *Sources*: Mortality data are from *Movimiento Nacional de la Población* and population data from census years, for more details see Section 2.1.

Are these trends robust to other indicators of inequality? In Figure 7 we estimate health inequalities in Spain using data from crude death rates with different measures of inequality.[5] First, we computed the mean logarithmic deviation (GE(0)), the Theil index (GE(1)), and the Atkinson index (A(2)). These indicators of inequality assume a greater sensitivity to mortality differences occurring either at the bottom, the middle, or the upper part of the distribution, but overall, we observe that inequality trends obtained with the Gini methodology are robust to the use of these other inequality indicators. Indeed, a look at the Atkinson index (A(2))—which gives more weight to mortality differences among provinces placed at the bottom part of the distribution (i.e., the healthiest provinces)—suggests even more dramatic changes occurring in the mid-19th century and during the Civil War. Next, we used the weighted Gini index by the level of population in each province. Despite the fact that provinces have relatively similar surface areas, they vary widely in terms of population densities. To account for outliers, we also computed bootstrapping standard errors for the Gini index. In both cases, our material analysis of health inequality remains unchanged.

Additionally, we display results with more intuitive range measures of inequality such as the evolution of the P90/P10, P90/P50, and P75/P25 ratios.[6] In order to compute range measures, provinces are ranked according to their average crude death rates (starting from the most to the least

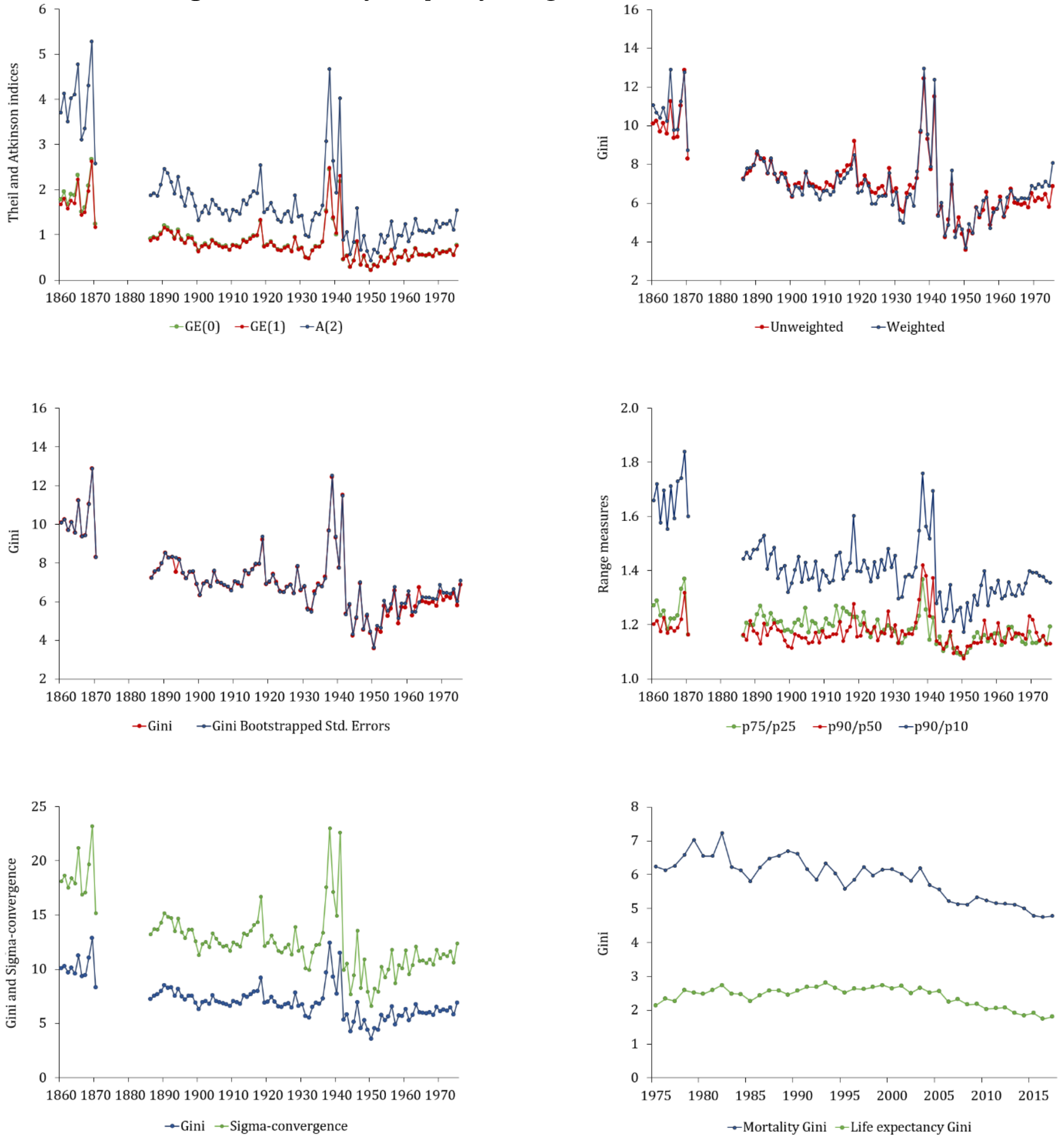
[5] The inequality indices differ in their sensitivities to differences occurring at different parts of the distribution. In particular, the Gini index is most sensitive to differences registered at the middle part of the distribution.
[6] Here *P* stands for the different percentiles of the distribution.

favored ones) and organized into percentiles. Here, the first decile (i.e., P0/P10) contains the 10 percent of provinces with the lowest average mortality rates, the second decile (P10-P20) the next 10 percent, and so on. In this sense, the P90/P10 is the ratio between the crude date rates registered by the 10 percent "less-healthy" provinces and the average crude death rates registered by the "healthiest" provinces (at the bottom 10). The P90/P50 measures the distance between the "least healthy" provinces and those placed in the middle part of the distribution, and the P75/P25 registers the distance between the upper-middle and the lower-middle parts of the distribution, avoiding potential outliers at the extremes. Our bottom line using these ratios is that these measures of inequality display the same general picture as the Gini index and suggest that most inequality changes were driven by changes at both extremes of the distribution (P90/P10).[7]

We also computed the so-called sigma-convergence to capture if there was a period when the variance of average mortality levels of compared provinces declined. The evolution of the sigma-convergence shows very robust findings compared with the previous ones. Finally, we also use the life expectancy data available since 1975 (see Figure 1) to show that other measures of health, such as the number of years lived, display a very similar picture to that obtained with the mortality Gini.

[7] As Figure 7 shows, the P90/P10 ratio indicates that the least-favored provinces registered mortality rates between 20% and 80% above the most-favored ones.

Figure 7. Mortality inequality using different measures, 1860–2017



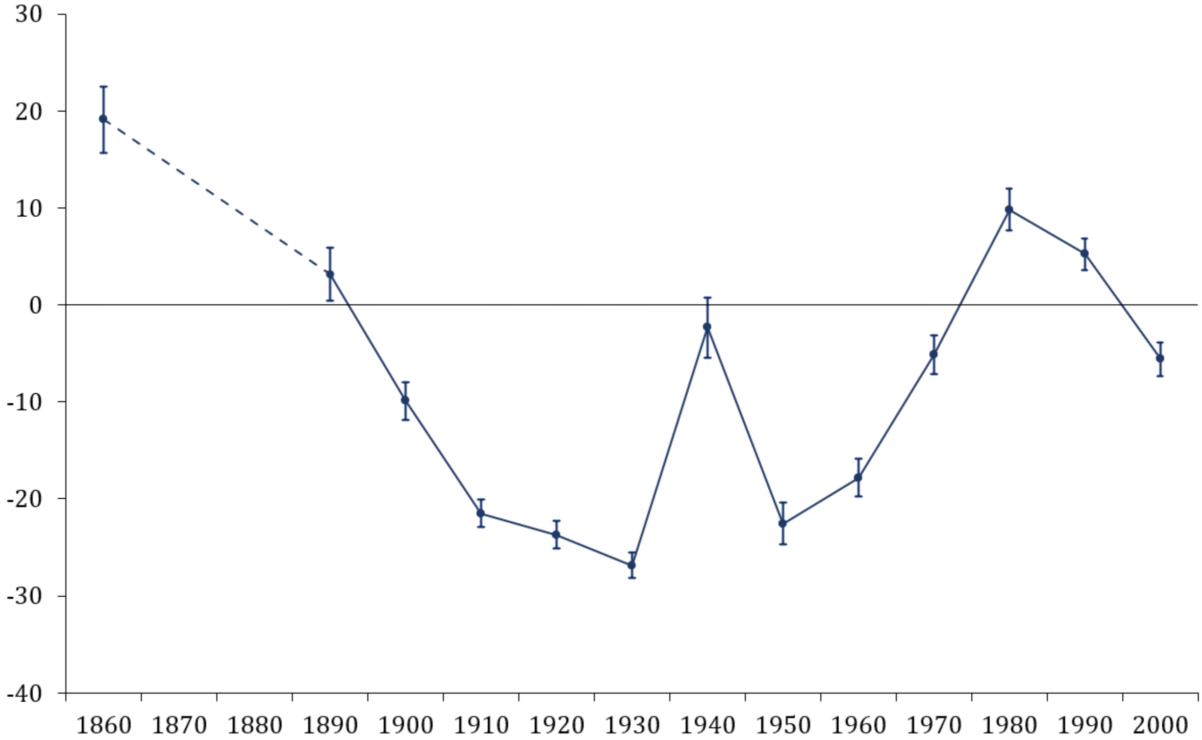
Notes: For details on methods see text in Section 3.1. *Sources*: Mortality data are from *Movimiento Nacional de la Población* and population data from census years, for more details see Section 2.1.

We also formally tested for beta-convergence, allowing us to see the rate and whether or not provinces with higher mortality rates improved faster than provinces with lower mortality rates (Barro and Sala-i-Martín 1995). If $g_{i,t,t+T} \equiv \log (y_{t+T}/y_{i,t})$ (2) represents the province's annualized growth rate in the crude mortality rate between t and $t+T$, there would be absolute beta-convergence (divergence) if beta (β) is statistically significant and negative (positive) according to $g_{i,t,t+T} = \alpha + \beta\,(y_{i,t}) + u_{i,t}$ (3).

In Figure 8 we split the data into decadal intervals, and following equations (2) and (3) we plot the β coefficients with their associated 95% confidence intervals. As already seen with the mortality

Gini and other index of inequality, there is absolute divergence in the period of the 1860s ($\beta > 0$), but gradually, throughout the end of the 19th century and the first three decades of the 20th century, this turned into a process of convergence, meaning that provinces with higher mortality rates improved faster in terms of health than provinces with lower mortality rates. This was, however, interrupted during the 1930s, and this process of convergence reversed in the first half of the 20th century. In the last decades of the 20th century, despite $\beta > 0$, the speed of divergence slowed down and by the 2000s it turned again to greater convergence.[8] We next present each of these periods in detail.

Figure 8. Beta-convergence in crude death rates across Spanish provinces



Notes: For methods see text in Section 3.1. We split the annual data into decadal intervals, and following equations (2) and (3) we plot the β coefficients with their associated 95% confidence intervals. *Sources*: Mortality data are from *Movimiento Nacional de la Población* and population data from census years, for more details see Section 2.1.

3.2. A long period of convergence

The first period of health convergence across provinces between the 1860s and 1950s coincided with the epidemiological transition that started in 1880, when, as in other Western nations, birth rates remained stable, death rates began to fall, and population growth accelerated due to the end of epidemics and decline of infant mortality (Omran 1971).[9] Additionally, urbanization in the 1920s

[8] Note that we lack data for the years 1871–1885, so we left two empty spaces to illustrate missing data. For the growth rate of 1860, we employed 1860 and 1890, as we lacked data for 1870 and 1880.

[9] That means a transition from a regime of low population growth associated with high birth rates and high death rates to one of population growth given a context of falling death rates, along with remaining high birth rates. The beginning

scaled mortality down (Galofré-Vilà 2021). When urban centers began the fight against mortality with public health movements and sanitary reforms, the urban penalty fell, and living in a rural area was no longer a better option in terms of longevity. For instance, if by 1900 a person living in an urban area (the capital of a province) could expect to live 5-6 years shorter than those living in rural areas, by 1930, a reversal had occurred (Pérez Moreda et al. 2015).

A first interruption in the decline of regional inequalities in Spain during the 1910s was likely due to the economic disruption associated with World War I, whose effects were unevenly distributed across regions (Rosés and Sánchez-Alonso 2004). Despite the fact that Spain was a neutral country and did not send men to war, early in the war its economy enjoyed a short-lived export boom, which fostered industries located in the northern regions (the main producers of textiles, machinery, and chemical products), and penalized traditional Spanish exports of vegetables and Mediterranean citrus. Yet the war also brought inflation and northern regions were hit hardest when the international markets were closed and prices started to rise. These events not only affected the economic and labor outcomes of men, but also, as recently shown by Galofré-Vilà and Harris (2021) for the city of Barcelona, there was a decline in the health of women in these industrial centers.

These findings closely align with the work from Rosés and Sánchez-Alonso (2004, 405) when looking at other indicators of living standards. According to them, "we show that substantial [real] wage convergence across regions took place prior to World War I [between 1850 and 1913, however]… the process of wage convergence was interrupted by World War I, which produced a sharp increase in regional wage differentials. These increases proved to be temporary, however; wage convergence re-emerged in the 1920s." Later on, with the 1918 influenza pandemic, Chowell et al. (2014) also "revealed high geographic heterogeneity in pandemic mortality impact… with the North experiencing highest excess mortality rates."

3.3. The Spanish Civil War and Franco's dictatorship

A more intense interruption of the reduction of regional health inequalities occurred during the Civil War (1936–1939) and the immediate post-war years, when Gini coefficients climbed from 7.3 in 1936 to 11.5 in 1941. Following the reforms implemented by the Republican governments and increasing tensions between conservative factions and leftist organizations, a military coup initiated the confrontation.[10] In terms of deaths, the Civil War was a demographic catastrophe. It is estimated

of the epidemiological transition in Spain has been placed at 1880, when the death rate began to fall, accelerating the population increase. Mortality and population were stabilized in the first half of the 20th century, when birth rates also fell, with the transition being completed by 1960. See Pérez Moreda et al. (2015) for a review of these demographic issues in historical Spain.

[10] More controversial reforms dealt with land distribution, worker protections, female suffrage, and the separation of church and state.

that up to 800,000 people died during the war, out of a total population of 23.6 million in 1930 (Preston 2011). Although women also suffered the calamities of the Civil War, they were not sent to the front lines to die, so women reached lower mortality Gini levels during this period compared to men. The war divided the population into two fronts: republicans (loyal to the left-leaning Second Spanish Republic) and the nationalists (led by Franco), with most deaths (as Figures 2 and 3 show) being concentrated among the male population and in the south (i.e., Ciudad Real, Badajoz, Jaen, and València), thus likely increasing regional inequalities. As noted by Ortega and Silvestre (2006, 55), "during most of the war, the population was distributed in two zones of about the same size. However, … the demographic consequences of the war were different in one side and another."

During the first decade that followed the defeat of the Republic in 1939, the mortality Gini resembled its prewar downward trend. However, an inflection point occurred thorough the second decade of the early Francoism, when mortality Gini coefficients increased from 3.6 in 1950 to 6.3 in 1960.[11] In terms of social policy and healthcare programs, Franco's regime made few changes with respect to the prewar period (Pérez Moreda et al. 2015), while some of the initiatives implemented implied an unequal distribution of resources that did not equally match the emergent needs (Bernabeu-Mestre et al. 2006). For instance, Pérez Moreda et al. (2015) pointed out that the *Ley de Bases de Sanidad* of 1944, which aimed to reform sanitary conditions, was just a continuation of the prewar model, and Pons-Pons y Vilar-Rodríguez (2015) found the share of money devoted to health and healthcare (*Dirección General de Sanidad*) was about the same between 1943 and 1958 (1.05% compared to 1.02% from the total Spanish budget).[12]

Likewise, the health insurance law of 1942 was very similar to the one passed in July 1936, under the government of the Republic, and it still left out the majority of farmworkers and jobless people. The regime started some health and educational campaigns aimed at mothers and infants (for instance, the *Ley de Sanidad Maternal e Infantil* of 1941), which while successful in continuing to combat infant mortality, actually increased health inequalities. For instance, Bernabeu-Mestre et al. (2006, 193) denounced the fact that "one of the characteristics that defined those initiatives was the unequal distribution of resources in the provinces most affected by infant mortality where, paradoxically, certain resources were less developed." In this regard, Barciela (2001) and Bernabeu-

[11] The Francoist dictatorship lasted until Franco died in 1975, and it is possible to identify two political stages of the dictatorship. The first stage, called the early Franco regime, spans from the end of the Civil War in 1939 until the end of the autarkic policies with the Stabilization Plan of 1959. The late Francoist regime, characterized by openness and economic success, spans from 1960 to Franco's death in 1975 and the transition to democracy.
[12] Specifically, they argue that "after the Civil War, there was the *Ley de Bases de Sanidad* of 1944, which aimed to reform sanitary conditions, but it just continued the essential characteristics of the prewar model" (Pérez Moreda et al. 2015).

Mestre et al. (2006) pointed out the absence of equitable economic criteria in the provision of healthcare, the implementation of which responded to ideology and socio-political control.[13]

During the 1950s, there were important epidemiological changes that likely affected provinces differently. For instance, the antibiotic revolution was highly successful in reducing some poverty-related causes of death, such as communicable and infectious diseases that mostly hit rural areas. At the same time, the decline of infectious and communicable diseases meant the rise of degenerative diseases, such as cancers and diabetes in richer and more developed provinces. The nutritional transition was also manifested more in urban and more economically developed urban areas (Cussó Segura and Garrabou Segura 2007),[14] and in the 1950s, migration between rural and urban settings increased to a new height—being the first time that people from provinces in the south (Andalusia, Extremadura, and Castile-La Mancha) migrated massively to Barcelona and Madrid (Silvestre 2010; Sánchez-Alonso 1995). All these factors likely helped to create a complex epidemiological framework that contributed to increasing regional health inequalities, but this time with rural provinces in Andalusia and economic hubs in the Basque Country and Madrid performing better than the rest.

During the second stage of the Francoist regime (1960–1975), the mortality Gini remained fairly stable at around 6. Importantly, Franco's government limited increases in wages and set them at a national level, easing any regional difference across provinces (Vilar Rodríguez 2004). Yet by the end of the 1950s, Spain's economic and political situation was also very fragile, and reforms under the *Plan de Estabilización y Liberalización Económicas* of 1959 ended with autarky and opened up the Spanish economy to the European market. In principle, these reforms have been seen as highly successful, starting a Golden Age of economic prosperity where gross domestic product (GDP) per capita rose seven times faster between 1950 and 1974 than in the previous hundred years (Prados de la Escosura 2017; Prados de la Escosura and Rosés 2009). New reforms were also implemented to narrow some existing social tensions between regions. For instance, although the efforts were modest, compulsory health insurance was expanded, and, in 1953, farmworkers were added to the social scheme. Later on, the *Ley de Bases de la Seguridad Social* of 1963 sought to unify and integrate the various social insurances. However, this act continued to marginalize those without stable ties to the labor market, and funding relied on employers' and workers' compulsory contributions.

[13] Other developments in terms of health included a rudimentary system of pensions for senior citizens in 1947 (*Seguro Obligatorio de Vejez e Invalidez*) and coverage for labor accidents (*Ley de Accidentes de Trabajo*). However, these were poorly funded.
[14] The nutritional transition involved the transformation of basic diets—based on bread, potatoes and legumes—through the incorporation of highly nutritional products, such as meat, milk, sugars and vegetables.

3.4. Spain under democracy

Once Franco died, and through to the first years of the transition to democracy, mortality Ginis for men continued to increase, reaching a Gini coefficient of 8 in 1982. Notably, provincial health inequalities for women started to decline in the 1970s, while, for males, the decline began more than a decade later. Although the right to social security was enshrined in Article 41 of the Spanish Constitution of 1978, it was not until the elections of 1982, when the socialist party achieved the majority, that modern democracy and social policy started. With the rollout of hospitals in each provincial center that began in the 1970s, a significant number of programs were devoted to mothers, including, but not limited to, the supply of primary and open care and family planning. Santesmases (2018) also pointed out that Prontosil and sulfa drugs only became widespread across Spain in the mid-1960s.

In the 1980s, healthcare also became universal, the system of pensions for senior citizens was further developed, and unemployment benefits were expanded. This has the potential to further explain the decline of regional differences in mortalities for both men and women. As noted by González and Rodríguez-González (2021, 104), with the "universal health insurance system, … most health care is provided free of charge by public hospitals and primary care centres. These features might mitigate the impact of income inequality on health and mortality." Moreover, in the 1990s (following the *Pacto de Toledo* of 1995), regions gradually launched programs for low-income families. The last step of this transition came with the *Ley General de Sanidad* of 1986 and *Ley de Sanidad* of 2003, which allowed for the health care systems (along with education) to be decentralized among Spanish regions.

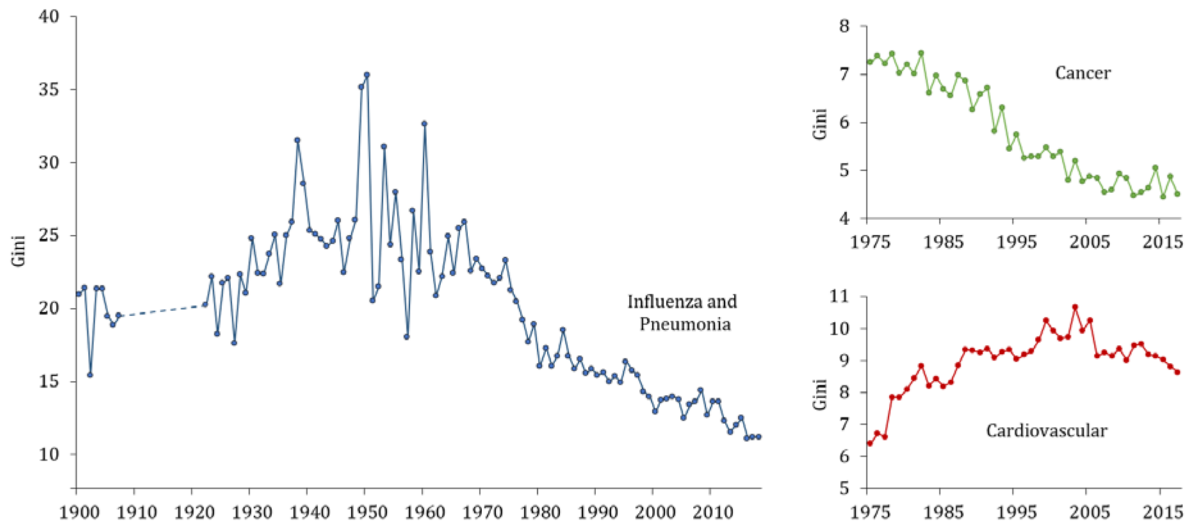
3.5. Mechanisms

On the potential causes for health to converge, Figure 9 presents mortality Ginis for different causes of death. From the *Movimiento Nacional de la Población*, we collected new data from the number of deaths of influenza and pneumonia. We decided not to collect data for other causes, due to coding transfers in the different causes of death overtime and because, it is unknown how well deaths from cancers or cardiovascular problems were recorded in the past. We combined deaths from influenza and pneumonia to proxy communicable and infectious diseases (expressed in per thousand population). For the last 45 years, we also use age-adjusted mortality rates from cancer and cardiovascular problems calculated by the *Instituto Nacional de Estadística*.

We find divergence in the regional deaths from infectious and communicable diseases, starting to increase during the Civil War and reaching a plateau during Franco's 40-year dictatorship and converging thereafter. Nowadays these are causes that can be cured with relatively inexpensive treatment and highly avoided with better nutrition, but sulfa drugs, providing the first effective treatment to combat infectious and communicable diseases, were not discovered until 1930, (Jayachandran et al. 2010). Moreover, in Spain, it was not until 1944 that penicillin was first used (*La Vanguardia* 21 September 1944), and it was not until 1965 that the government assumed its costs; being unevenly used across regions in the 1940s and 1950s given its cost and availability (Santesmases 2018).

Despite the fact that the other two graphs display data since 1975, they concern the two leading causes of death in Spain, accounting for more than 60% of all deaths in 2019.[15] There has been a solid process of convergence across Spanish regions in deaths from cancer, which can be linked to preventive measures and universal treatment financed by the national system of social security. By contrast, regional differences in cardiovascular deaths increased among provinces that respond to different patterns of life-style and the consumption of red meat and alcohol.

Figure 9. Gini mortality from cancer, cardiovascular problems, diabetes and influenza, 1900–2017.



Notes: Gini coefficients are expressed as percentages and range from 0 to 100. *Sources*: Mortality data are from *Movimiento Nacional de la Población* and population data from census years, for more details see Section 2.1.

4. Conclusions

This paper describes how health inequalities evolved across Spanish provinces since 1860. We find a process of convergence from 1860 to 2017, interrupted by World War I and the Civil War. The legacy left by Franco's 40-year dictatorial regime is also one of divergence, increasing health disparities across regions between the 1950s and 1980s.

[15] Data on cause-specific mortality are from *Instituto Nacional De Estadística.*

In the course of the 20th century, Spain, like other countries such as Italy, France, Taiwan and Japan, improved longevity into new and uncharted territories, moving from a regime of pestilence and high mortality levels into places where people enjoy the healthiest and longest lives. Of course, this dynamic, as part of the demographic transition, encompasses new challenges associated with longevity, such as an inclusive health system to cover all citizens. In this sense, Spain seems to have fared well in the most recent decades, creating a good environment for health to converge across different provinces and Spanish vicissitudes. Yet the COVID-19 pandemic has magnified the weaknesses and vulnerabilities of the Spanish public health system, and interacted with political goals, making it likely that differences can grow again.

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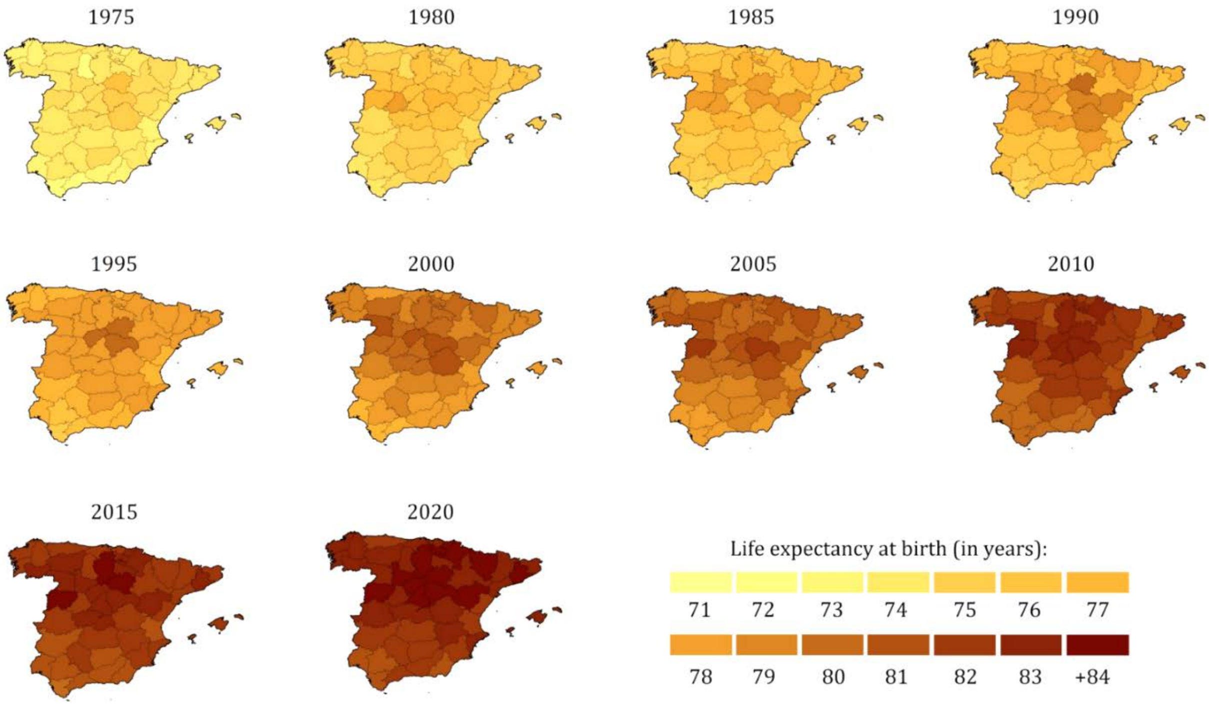
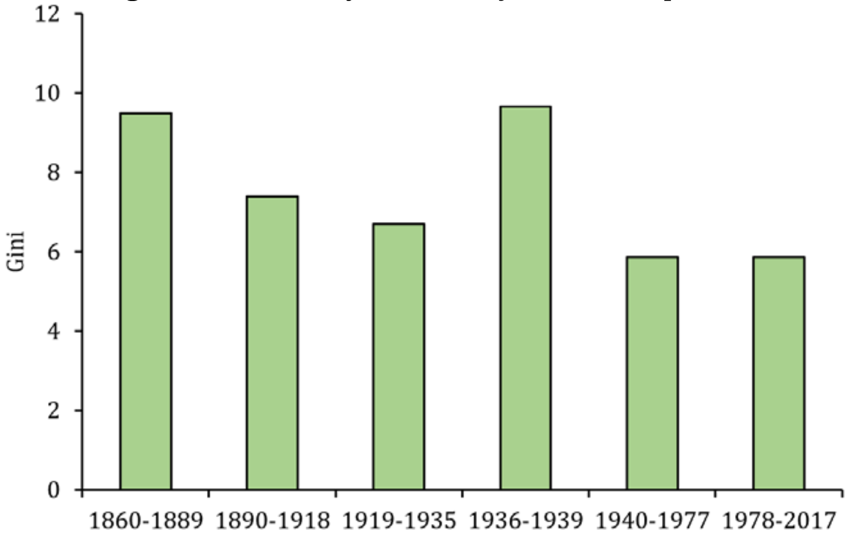
Figure A1. Life expectancy across Spanish provinces, 1975–2020



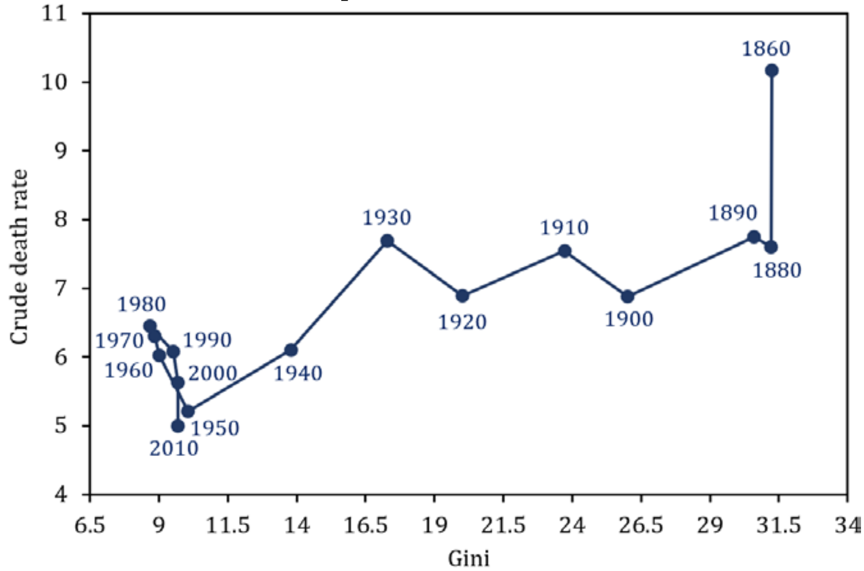
Notes: Life expectancy at birth is defined as the average number of years that a newborn could expect to live if he or she were to pass through life subject to the age-specific mortality rates of a given period. As explained in Section 2, we are not showing data from Ceuta, Melilla, Santa Cruz de Tenerife, and Las Palmas. *Sources*: *Instituto Nacional de Estadística*.

Figure A2. Mortality Gini in major historical periods



Notes: Gini coefficients are expressed as percentages and range from 0 to 100. For the definition of the historical periods see Section 3. *Sources*: Mortality data are from *Movimiento Nacional de la Población* and population data from census years, for more details see Section 2.1.

Figure A3. The decadal relationship between crude death rates and the mortality Gini



Notes: Each dot summarizes the mean decadal values of crude death rates and the mortality Gini. As explained in Section 2, data for 1870 were missing and data for the 1880 related to the second half of the 1880s. The line of tendency connects the dots in chronological order. *Sources*: Mortality data are from *Movimiento Nacional de la Población* and population data from census years, for more details see Section 2.1.